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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/576,375	04/19/2006	Anders Oedegaard	1-17265	9080
1678 7590 12/20/2011 MARSHALL & MELHORN, LLC FOUR SEAGATE - EIGHTH FLOOR TOLEDO, OH 43604				
EXAMINER SCULLY, STEVEN M				
ART UNIT		PAPER NUMBER		
1727				
MAIL DATE		DELIVERY MODE		
12/20/2011		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Office Action Summary****Application No.**

10/576,375

**Applicant(s)**

OEDEGAARD ET AL.

**Examiner**

STEVEN SCULLY

**Art Unit**

1727

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
  - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
  - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 September 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 5) ☒ Claim(s) 37-61, 71 and 72 is/are pending in the application.
- 5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 37-61, 71 and 72 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-GB08)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_
- Paper No(s)/Mail Date \_\_\_\_

**DEVICE AND METHOD FOR INCREASING THE CONCENTRATION OF FUEL IN A  
LIQUID FLOW SUPPLIED TO THE ANODE OF A FUEL CELL**

Examiner: Scully S.N.: 10/576,375

**DETAILED ACTION**

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 23, 2010 has been entered. Claim 37 has been amended. Accordingly, claims 37-61, 71 and 72 remain pending in the application.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

***Claim Rejections - 35 USC § 102***

3. Claim rejections of claims 37-39, 41-43, 45, 46, 54, 56-58, 60, 61 and 71 under 35 U.S.C. 102(e) as being anticipated by Zimmermann (US2004/0058222A1) are withdrawn because the claims have been amended.

***Claim Rejections - 35 USC § 103***

4. Claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222A1).

With respect to claim 37, Zimmermann discloses a passive control of fuel concentration in a liquid feed fuel cell. The device comprises a fuel delivery subsystem 30 (applicant's fuel storage device) having a throughflow side 14 disposed therein. The device comprises a membrane (16) which swells upon contact with the methanol (22) and contact between the membrane (16) and the fuel mixture (24) in reservoir (14) causes methanol to migrate from the membrane (16) to the fuel reservoir (14), increasing the concentration of the methanol in the mixture of methanol and water. Preferably the membrane (16) is impermeable to water to thereby prevent the back migration of water from fuel reservoir (14) to methanol reservoir (12). See [0028].

Zimmermann does not disclose the claimed configuration wherein the throughflow device comprises walls configured as at least one membrane as claimed. However, it is the position of the Examiner that this change of shape is an obvious matter of choice which a person of ordinary skill in the art at the time of the invention would have found obvious absent persuasive evidence that the particular configuration is significant. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966); MPEP 2144.04.

With respect to claims 38, 39 and 71, Zimmermann discloses the system to be used with a direct methanol fuel cell. See [0005].

With respect to claim 41, Zimmermann discloses temperature differentials between the two reservoirs can adjust the equilibrium concentrations. See [0021]. Thus, a heating device would be necessary.

With respect to claims 42 and 43, Zimmermann discloses that the device comprises reservoirs (12, 14). These are interpreted as heat insulators comprising insulating material.

With respect to claim 45, Zimmermann discloses the system comprising a tank or container (12, 14).

With respect to claim 46, Zimmermann discloses the device contains fuel in pure or in concentrated form. See [0008].

With respect to claim 47, Zimmermann does not disclose the particular fuel concentration claimed. However, Zimmermann recognizes concentration range to be a relevant factor in developing a system for controlling the concentration of methanol in the system. See [0006]. It would have been obvious to one of ordinary skill in the art to vary the concentration of the fuel based on its intended use. Further, it is the position of the examiner that the fuel concentration is not critical.

With respect to claims 48 and 52, Zimmermann does not explicitly disclose a support or stabilizing device. However, obviously it is beneficial to provide a supportive structure to a system to prevent physical damage.

With respect to claim 51, Zimmermann does not disclose the throughflow rate. However, Zimmermann recognizes size is a relevant factor in developing a system for controlling the concentration of methanol in the system. See [0006]. Depending on the

size of the membrane, the throughflow rate in ml/min would vary. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the size of the liquid feed depending on the intended use (i.e. intended flow rate to a fuel cell).

With respect to claim 54, Zimmermann discloses the device comprises a channel 14 situated in the interior of the fuel storage device 30. See Figure 1.

With respect to claim 55, Zimmermann does not disclose the cross-section of the channel. However, it is commonly known to make a pipe-like device circular in cross-section. Further, it is the position of the examiner that the shape of the membrane is not critical.

With respect to claim 56, Zimmermann discloses the device comprises a filter, for example at membranes (36,38,40 and 16). See Figures 1 and 2.

With respect to claim 57, Zimmermann discloses the fuel and/or carrier component is a liquid. See [0014].

With respect to claims 58, 60 and 61, Zimmermann discloses the carrier component is water and the fuel is methanol. See abstract.

With respect to claims 44 and 72, Zimmermann does not disclose a spiral throughloop. However, depending on the residence time, it would be obvious to one of ordinary skill in the art at the time of the invention to recycle the outlet stream from the device back into the device to insure the proper methanol concentration is achieved if the residence time was too small.

5. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) as applied to claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Neutzler et al. (US2002/0076599)

With respect to claim 40, Zimmermann discloses a direct methanol fuel cell which creates water. Neutzler et al. disclose a direct methanol fuel cell including a water management system. To aid in supplying methanol and water to the anode, it would be beneficial to recirculate the aqueous fuel mixture after the fuel cell reaction, and recycle the water generated at the cathode in the fuel cell reaction, as well as the water arriving at the cathode via diffusion and electro-osmotic drag. See [0005]. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a recycling feed of the water from the cathode to the inlet fuel in order to aid in supplying methanol and water to the anode.

6. Claims 49 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) as applied to claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Beisswenger et al. (US2004/0003720).

With respect to claims 49 and 53, Zimmermann does not disclose a support structure comprising a foamed material. Beisswenger et al. disclose a system for hydrogen separation. The separation device is a membrane. See [0009]. Beisswenger et al. further disclose a support structure (8) on the membrane made of a foamed material. This foam is used to provide support for the membrane. See [0057]. It would have been obvious to one of ordinary skill in the art at the time of the invention to

include a foamed support on the separation membrane of Zimmermann because it provides support for the membrane.

7. Claims 50 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) as applied to claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Shurtleff (US2003/0228252).

With respect to claim 50, Zimmermann does not disclose the membrane is a perfluorosulfonic acid/polytetrafluoroethylene copolymer in acidic form. Shurtleff discloses Nafion (PFSA/PTFE) is a water-selective membrane which can be used to remove the water from a system. See [0037-0039]. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the membrane of Shurtleff because it provides a selective membrane for separation.

With respect to claim 59, Nafion inherently releases sulfonic acid and therefore the methanol/water mixture would inherently comprise an acid.

8. Claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222A1) in view of Leonard (US3,794,468).

With respect to claim 37, Zimmermann discloses a passive control of fuel concentration in a liquid feed fuel cell. The device comprises a fuel delivery subsystem 30 (applicant's fuel storage device) having a throughflow side 14 disposed therein. The device comprises a membrane (16) which swells upon contact with the methanol (22)



and contact between the membrane (16) and the fuel mixture (24) in reservoir (14) causes methanol to migrate from the membrane (16) to the fuel reservoir (14), increasing the concentration of the methanol in the mixture of methanol and water. Preferably the membrane (16) is impermeable to water to thereby prevent the back migration of water from fuel reservoir (14) to methanol reservoir (12). See [0028].

Zimmermann does not disclose the claimed configuration wherein the throughflow device comprises walls configured as at least one membrane as claimed. Leonard discloses a mass transfer device which comprises a capillary tube of semi-permeable membrane adapted for mass transfer between two fluids, one flowing through the tube while the second contacts the outside of the tube and is held within a wall. See Figures 8-12; description. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the mass exchange design of Leonard in the system of Zimmermann because Leonard teaches it is easily manufactured for reliability and a low cost. See column 1, lines 10-53.

With respect to claims 38, 39 and 71, Zimmermann in view of Leonard discloses the system to be used with a direct methanol fuel cell. See [0005].

With respect to claim 41, Zimmermann in view of Leonard discloses temperature differentials between the two reservoirs can adjust the equilibrium concentrations. See [0021]. Thus, a heating device would be necessary.

With respect to claims 42 and 43, Zimmermann in view of Leonard discloses that the device comprises reservoirs (12, 14). These are interpreted as heat insulators comprising insulating material.

With respect to claim 45, Zimmermann in view of Leonard discloses the system comprising a tank or container (12, 14).

With respect to claim 46, Zimmermann in view of Leonard discloses the device contains fuel in pure or in concentrated form. See [0008].

With respect to claim 47, Zimmermann in view of Leonard do not disclose the particular fuel concentration claimed. However, Zimmermann recognizes concentration range to be a relevant factor in developing a system for controlling the concentration of methanol in the system. See [0006]. It would have been obvious to one of ordinary skill in the art to vary the concentration of the fuel based on its intended use. Further, it is the position of the examiner that the fuel concentration is not critical.

With respect to claims 48 and 52, Zimmermann in view of Leonard do not explicitly disclose a support or stabilizing device. However, obviously it is beneficial to provide a supportive structure to a system to prevent physical damage.

With respect to claim 51, Zimmermann in view of Leonard do not disclose the throughflow rate. However, Zimmermann recognizes size is a relevant factor in developing a system for controlling the concentration of methanol in the system. See [0006]. Depending on the size of the membrane, the throughflow rate in ml/min would vary. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the size of the liquid feed depending on the intended use (i.e. intended flow rate to a fuel cell).

With respect to claim 54, Zimmermann in view of Leonard discloses the device comprises a channel 14 situated in the interior of the fuel storage device 30. See Figure 1.

With respect to claim 55, Zimmermann in view of Leonard do not disclose the cross-section of the channel. However, it is commonly known to make a pipe-like device circular in cross-section. Further, it is the position of the examiner that the shape of the membrane is not critical.

With respect to claim 56, Zimmermann in view of Leonard discloses the device comprises a filter, for example at membranes (36,38,40 and 16). See Figures 1 and 2.

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9. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) in view of Leonard (US3,794,468) as applied to claims

37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Neutzler et al. (US2002/0076599)

With respect to claim 40, Zimmermann in view of Leonard discloses a direct methanol fuel cell which creates water. Neutzler et al. disclose a direct methanol fuel cell including a water management system. To aid in supplying methanol and water to the anode, it would be beneficial to recirculate the aqueous fuel mixture after the fuel cell reaction, and recycle the water generated at the cathode in the fuel cell reaction, as well as the water arriving at the cathode via diffusion and electro-osmotic drag. See [0005]. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a recycling feed of the water from the cathode to the inlet fuel in order to aid in supplying methanol and water to the anode.

10. Claims 49 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) in view of Leonard (US3,794,468) as applied to claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Beisswenger et al. (US2004/0003720).

With respect to claims 49 and 53, Zimmermann in view of Leonard do not disclose a support structure comprising a foamed material. Beisswenger et al. disclose a system for hydrogen separation. The separation device is a membrane. See [0009]. Beisswenger et al. further disclose a support structure (8) on the membrane made of a foamed material. This foam is used to provide support for the membrane. See [0057]. It would have been obvious to one of ordinary skill in the art at the time of the invention

to include a foamed support on the separation membrane of Zimmermann because it provides support for the membrane.

11. Claims 50 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann (US2004/0058222) in view of Leonard (US3,794,468) as applied to claims 37-39, 41-48, 51, 52, 54-58, 60, 61, 71 and 72 above, and further in view of Shurtleff (US2003/0228252).

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With respect to claim 59, Nafion inherently releases sulfonic acid and therefore the methanol/water mixture would inherently comprise an acid.

### ***Response to Arguments***

12. Applicant's arguments with respect to claims 37-61, 71 and 72 have been considered but are moot in view of the new ground(s) of rejection.

***Contact/Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven Scully whose telephone number is (571)270-5267. The examiner can normally be reached on Monday to Friday 12pm to 8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara Gilliam can be reached on (571)272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. S./  
Examiner, Art Unit 1727

/Barbara L. Gilliam/  
Supervisory Patent Examiner, Art Unit 1727